

TECHNICAL NOTES

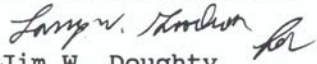
U.S. DEPARTMENT OF AGRICULTURE RENO, NEVADA SOIL CONSERVATION SERVICE

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AGRONOMY TECHNICAL NOTE NO. NV-65

SUBJECT: CPA - RESIDUE MANAGEMENT WITH CHISEL-TYPE
IMPLEMENTS

The attached Idaho Technical Note Agronomy No. 48 provides
useful information.


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Technical Notes

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AGRONOMY TECHNICAL NOTE NO. 48

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RESIDUE MANAGEMENT WITH CHISEL-TYPE IMPLEMENTS

The enclosed technical information was developed by Richard R. Johnson, Agronomist, for Deere and Company's Technical Center at Moline, Illinois.

This information does an excellent job of explaining the history of chisels and how and where to use them. This is an excellent guide to use with farmers and in SCS training plans.

Residue Management

WITH CHISEL-TYPE IMPLEMENTS

Summary

Where chisels are improperly used, it may be difficult to end up with 30% surface cover. But by considering one or more of the following, 30 to 50% surface cover after planting should be possible:

- Delay chiseling until spring or as close to planting as possible.
- Use sweeps or chisel spikes instead of twisted shovels.
- Consider a hydraulic lift option on disk or coulter gangs...or use a straight chisel plow.
- Select a frame with good fore/aft and vertical clearance.
- Do not operate deeper or faster than necessary to meet tillage objectives.

Introduction

Conservation tillage has been widely used to develop plans to achieve conservation compliance for highly erosive fields. The most popular form of conservation tillage in these plans has been mulch tillage--a system that involves full width tillage but leaves at least 30% surface cover after planting. Many plans may call for surface cover levels above 30%. Compared to totally eliminating tillage, some advantages for conducting tillage can include managing soil compaction, improved or lower cost weed control, mixing fertilizer and pesticides into surface soil, ability to use conventional planting equipment, avoiding yield losses that occur when poorly drained soils are not tilled, and a management system with greater flexibility. The challenge is to conduct tillage while maintaining surface cover. Chisel-type implements are among the most flexible primary tillage machines. By understanding a few key principles about chiseled implements, they can be adapted to play a major role in residue management needs, often with a minimal cost.

What is a Chiseled Implement?

Chisel plows differ from cultivators in that they are constructed of stronger and wider spaced shanks for primary tillage. The first chisel plows were developed in the 1930s for dryland small grain production. Chisels are still extensively used in the Great Plains to conduct shallow primary tillage without inverting the soil. Sweeps were and continue to be the most common ground engaging tool and are operated at 4 to 6 inch depths.

As chisels moved into higher rainfall areas, they were adapted to till deeper and to handle higher amounts of residue associated with crops like corn. Heavier-duty standards now allow tilling up to 12 inches deep. Also coulter or disk gangs are available in front of chisel standards. These cutting devices size residue so that it will flow through chisel standards without plugging. Likewise, new ground engaging tools have been developed to bury more residue and create deep trenches to capture water and reduce winter wind erosion. To assist in handling high quantities of residue and deeper tillage, vertical clearance of standards and fore/aft spacing of frames have been increased.

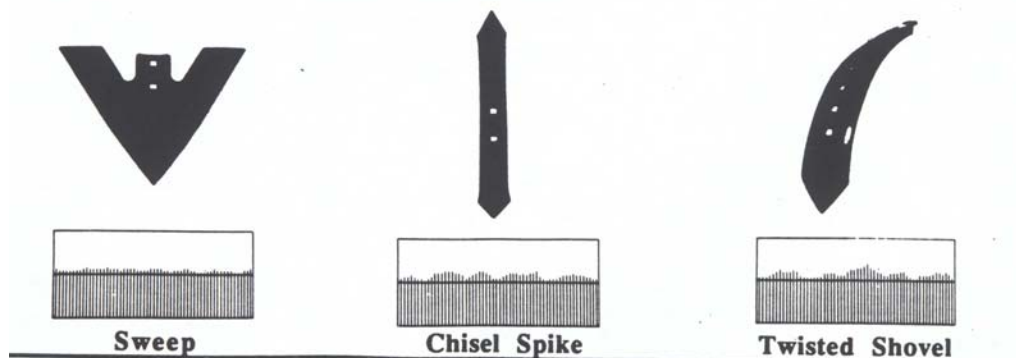


Figure 1. General types of ground engaging tools with typical surface roughness profiles.

Time of Tillage

Because chisels are primary tillage tools, they should be used where deep tillage is needed. On highly erosive fields they are best used after high residue crops such as corn or high yield small grains and sorghum. Also, don't assume chisels must be used just in the fall! If maximum quantities of surface cover are desired, delay chiseling until early spring. In the case of winter small grains, delay until closer to planting time. Cutting, sizing, and burying of residue can all occur during chiseling. Smaller pieces of residue and buried residue will decompose more easily. Delaying chiseling will slow decomposition. Even if residue is buried with a chisel, secondary tillage with machines such as field cultivators can bring this residue back to the surface. However, if buried residue is decomposed, this option is out.

Combination Chisels

In the Corn Belt several companies offer combination chisel machines that combine disk blades or coulters with the chisel standards. Although these options greatly increase machine flexibility, the associated cutting and sizing actions make it easier for the residue to decompose or be buried. In erosive areas with lower quantities of surface cover, it may be wise to simply avoid purchasing these options. On farms with diverse yields and soils, consider a combination chisel with hydraulic disk or coulters sections. Raising disk or coulters gangs out of the soil typically increases quantity of surface cover by 5 to 15%.

Ground Engaging Options

Sweeps, chisel spikes, and twisted shovels are the most common general types of ground engaging attachment. Each type comes in a variety of widths and styles that have only modest effects on maintaining surface cover. Yet, choosing the proper general type can have a profound effect on meeting surface cover targets. Where maximum quantities of surface cover are needed, sweeps will be better than chisel spikes which in turn will be better than twisted shovels. Sweeps often result in 5 to 15% more surface cover than twisted shovels because they lift and drop the soil rather than invert it. They also leave a field much smoother than spikes or shovels. Done on a contour or perpendicular to prevailing winds, channels created by spikes or shovels can greatly reduce erosion. But current erosion models give no credit for this roughness. As a consequence roughness can be a liability because farmers who choose to incorporate herbicides with secondary tillage may actually need one pass to create a level surface on which to spray and a second pass to incorporate the herbicide.







Table 1. Residue remaining with fall chiseling in a 125 bu/a corn and 45 bu/a soybean field.

Ground Engaging Tool	After Corn		After Soybeans	
	Straight Chisel	Disk Chisel	Straight Chisel	Disk Chisel
	-----% Residue Remaining-----			
3" Twisted Shovel	56	52	--	15
2" Chisel Spike	64	53	39	18
16" Sweep	72	59	36	23

Sweeps can be operated at the same depth as spikes or shovels. Some high crown sweeps are still in the marketplace and should be avoided in deep tillage because they will increase draft. At similar depths, medium or low crown sweeps require about the same draft as spikes or shovels. However, sweeps can more easily penetrate soil creating the impression of requiring more power if depth stops are not used to control depth. When using sweeps, maximum soil loosening and weed kill will be obtained with sweeps 1 to 2 inches wider than the spacing of standards.

Operating Speed and Depth

Increasing operating depth generally decreases quantity of surface cover, particularly on chisels equipped with disk or coulters options. Likewise, increasing operating speed will reduce surface cover. However, the greatest effect of speed occurs below 4 mph.

					
Low crown sweep leaves generous amounts of surface cover in both small grain and row-crop tillage. Low crown and wing angle mean less soil-stirring action, less ridging. Can be operated shallow or up to 10 in. deep. Good to very good moisture conservation. Excellent weed control tool. 16-, 18- and 24-in. widths. Leaves up to 80 percent residue in high-yielding corn.	Medium crown sweep stirs soil more aggressively than a low crown sweep. Results in better soil mixing. Can be operated shallow in small grains and up to 10 in. deep in row crops. Provides slight ridging effect. Moisture conservation is good to very good, making it ideal for small grains. Leaves up to 75 percent residue.	New wing-design wheatland sweep maintains its true cutting width over the life of the sweep. New attack point profile improves penetration in tough soils. Raised crown maintains point and penetration throughout the life of the sweep. 16-in. width. Leaves up to 75 percent residue.	Flat twisted shovel works like a mini-moldboard bottom. Delivers deep tillage action where more residue incorporation and mixing are desired. Leaves fields in roughened, erosion-resistant condition if operated on contour. Leaves up to 60 percent residue. Comes in 3- and 4-in. widths.	John Deere patented concave twisted shovel buries about the same residue amounts as flat twisted shovels. Gives better soil and residue flow. Cuts deep moisture-conserving grooves. Perfect for medium to heavy soils. 3- and 4-in. widths. Wears longer than twisted shovel. Leaves up to 50 percent residue.	2-in. chisel spike earns high marks for erosion control. Leaves more residue than either twisted shovel. Tills deep with good soil-shattering action. Creates mini ridge terraces. Tillage should be on contour or perpendicular to prevailing wind. Beveled point opens soil for improved water penetration. Leaves up to 65 percent residue.